4.3 INFRASTRUCTURE

The information contained in this section provides a brief overview of each infrastructure component and comments on its existing general condition.

The AETC's Facility Infrastructure Examination (FIX) Program conducts regular evaluations to rate the overall condition of infrastructure and base facility groups for its installations. A green-yellow-red system has been developed for rating the overall condition of these systems.

Red signifies that the system is in poor condition and will require major repair, upgrade, or replacement within two years to prevent possible mission impact.

Yellow indicates that the system is mission capable, but will require major repair or upgrade within five years.

Green means that the system is in good condition and only requires routine maintenance and repair.

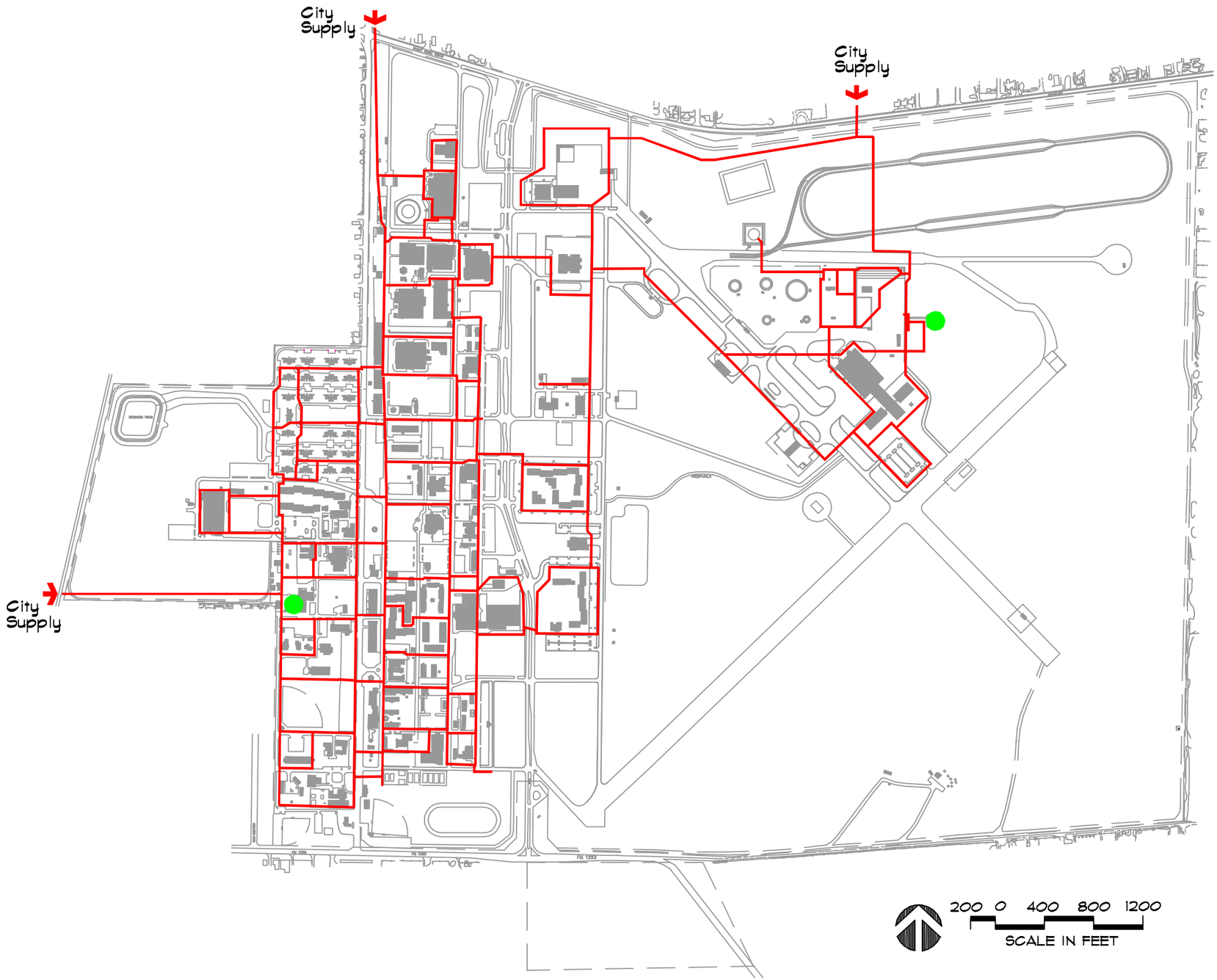
West Side Water Tower

The following table gives an overview of the condition ratings given by the FIX Program for existing infrastructure at Goodfellow AFB.

Infrastructure System	Base Rating 1993	1996
Water Supply	Yellow	Yellow
Sanitary Sewer	Yellow	Yellow
Storm Drainage	Yellow	Yellow
Natural Gas	Red	Green
Liquid Fuels	Green	Green
Electrical	Red	Yellow
Backup Power	Green	Yellow
HVAC	Yellow	Yellow
Communications	Yellow	Green
Base Pavements	Yellow	Yellow

4.3.1 Water Supply System

Potable water is supplied to Goodfellow AFB by the city of San Angelo. The city's source of water is obtained from several area surface reservoirs. The installation's water is received from the city's treatment plant through three separate water mains at an average pressure of 65 pounds per square inch. As illustrated in Figure 4.13, a 12-inch main enters the base on the north near Fort McKavett Road and runs south to feed the base distribution system. Two side-by-side eight-inch mains cross Christoval Road and enter the base on the west side. These lines run east to the short water tower and continue on to the distribution system. A 12-inch main



Revised 16 Apr 99

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Figure 4.13

Water Supply System

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with a six-inch meter enters the base distribution system from the north at the fire training area.

The base contains over 358,400 linear feet of water mains. Approximately 80 percent of the base is within a looped distribution system. Non-looped portions of the base include the new fire training complex and the area containing the logistics complex and security police facilities.

Two 400,000 gallon elevated storage tanks provide backup water supply and water for fire protection. The taller tower, constructed in 1994 as part of the new fire training area, helps to maintain water pressure in the base supply system. During periods of heavy irrigation, the south end of the base experiences low water pressure. This is not only an inconvenience to base personnel, but a life safety issue in providing adequate fire protection. The water storage tanks have an automated water pressure regulator that is non-functional. This situation creates a need for manual operations and frequent monitoring to preclude degraded fire protection capabilities.

4.3.2 Sanitary Sewer

The installation's sanitary sewer system consists of approximately 78,700 linear feet of sewer mains. The system is a gravity flow collection system, except for 11 lift stations and force mains. Eight of these lift stations connect the fire training facilities to the main base system. The base does not operate its own wastewater treatment facility but discharges all wastewater into city owned sewer lines at one of three discharge points. The collection system and discharge points are illustrated in Figure 4.14.

A majority of the system has been recently replaced with PVC mains. The remaining portions, predominately in the family housing area, consist of vitreous clay pipe that is being replaced as needed. A previous camera survey of the sanitary sewer mains revealed several open joints and infiltration of tree roots into the lines, particularly within the military family housing area.

Three facilities on base — the south guardhouse, the lodge building, and the hazardous waste accumulation site — are not connected to the sanitary sewer system but are serviced by on-site septic tank and lateral systems.

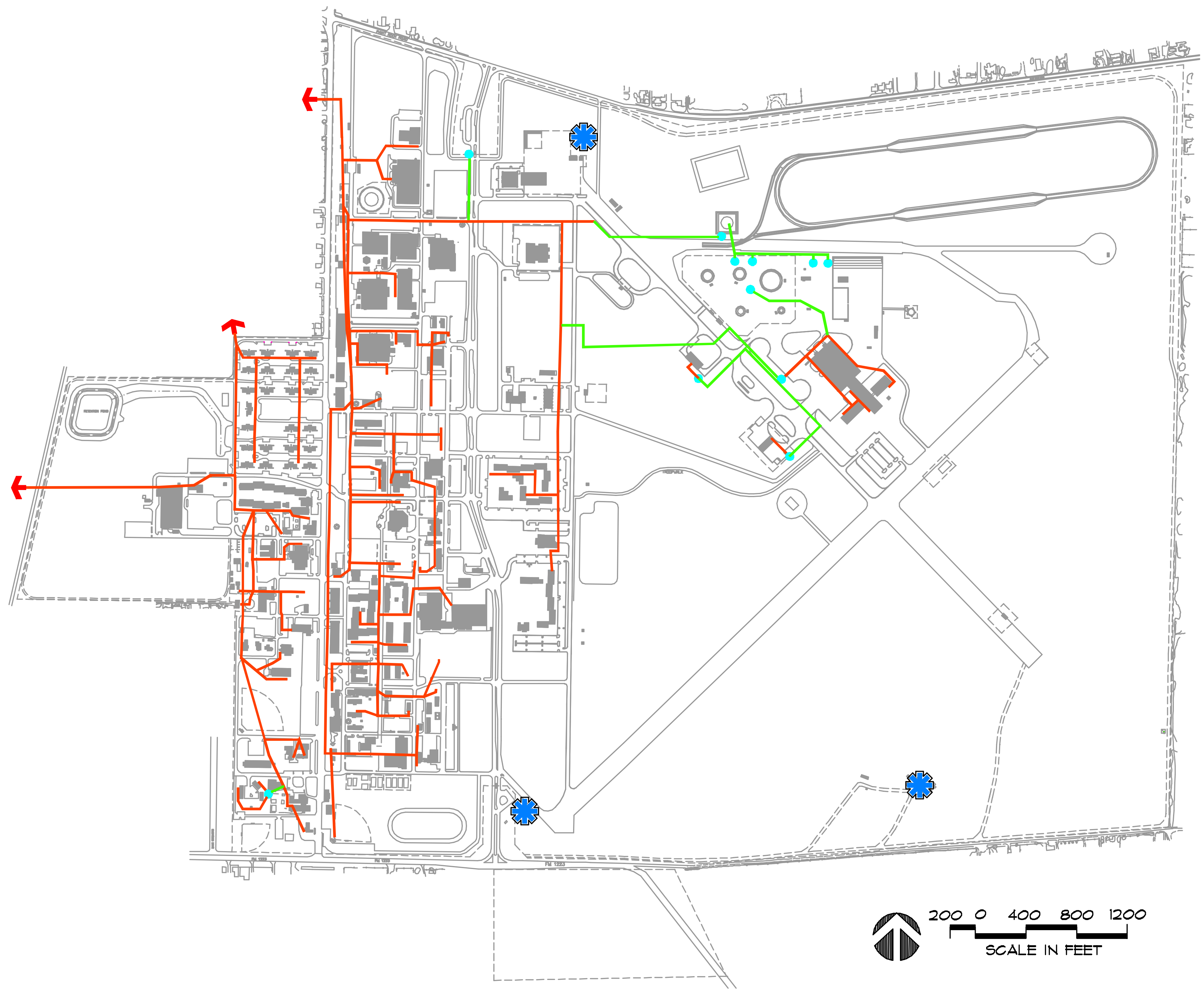
4.3.3 Storm Drainage

The storm drainage system at Goodfellow AFB is a combination of underground collection pipes and open surface ditches. Most areas west of Scherz Boulevard are overland flow, and several streets and parking lots are used for channeling surface drainage. The main cantonment area is drained through an underground collection system. Collected runoff is discharged off base at one of five stormwater discharge points. The main stormwater collection system and location of discharge points are illustrated in Figure 4.15.

Revised 19 Apr 99

Figure 4.14

Sanitary Sewer System



Sewer Line

Force Main

Lift Station

Septic Tank

Discharge Point to City System

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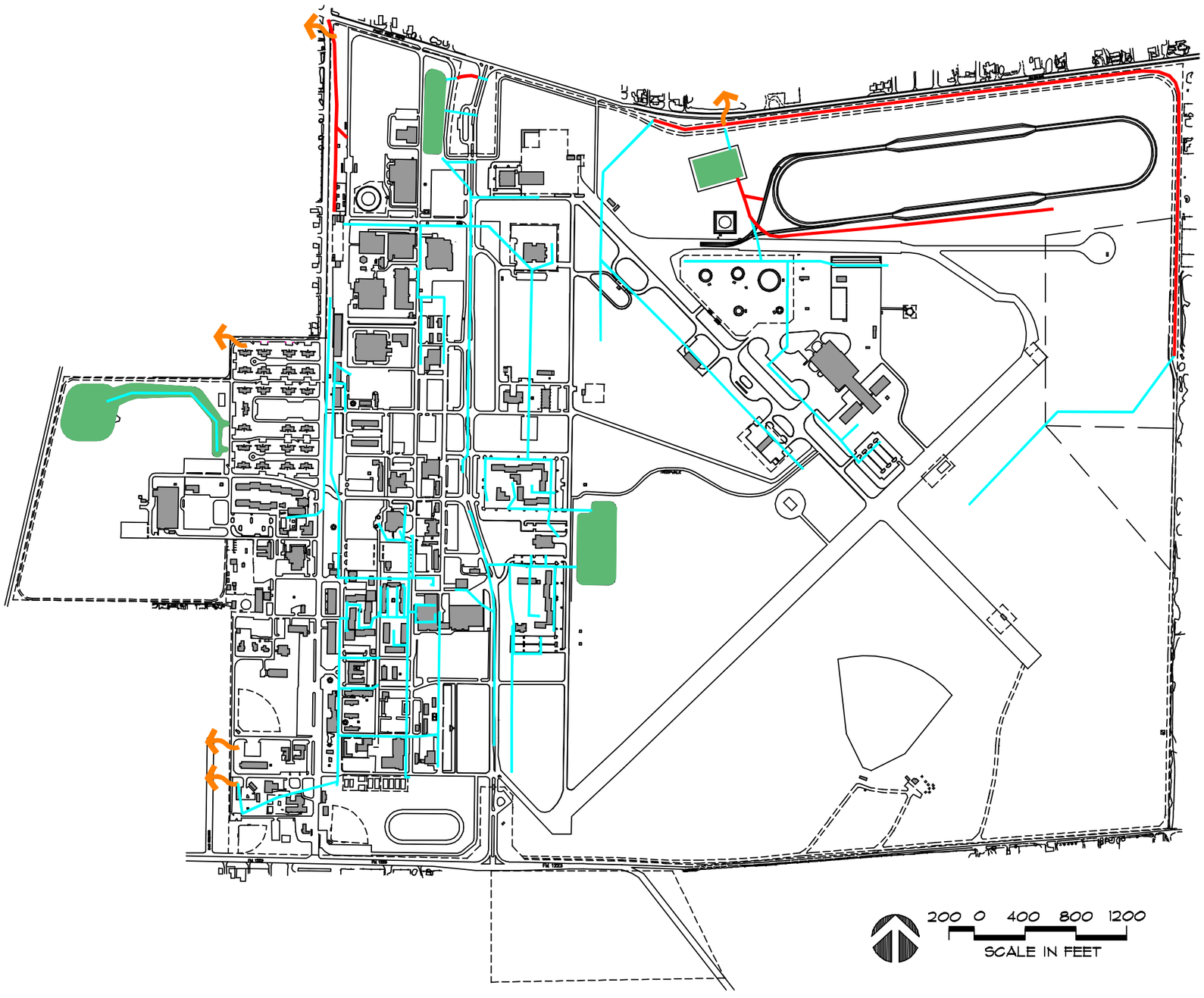

Revised 15 Oct 99

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Figure 4.15

Storm Drainage System

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The southeastern part of the base collects surface flow into a system of catch basins and underground drainage pipes that were installed with the former airfield. Water collected in this area is discharged into an open channel that runs along the east and north base perimeter to a discharge point on the north side of the base. The fire training area has its own surface and underground collection system. Stormwater is collected and processed with the wastewater and eventually discharged into the city sewer system. This is currently being evaluated to determine the best way to reduce the excessive amount of sewer discharge.

The intelligence training area recently installed an underground drainage system to handle stormwater runoff in its area.

Temporary ponding occurs in the clinic area, located on the west side of the base, because of backed up stormwater resulting from surface runoff. A lack of positive drainage in the military family housing area creates flooding problems during periods of heavy rain. Another problem area is the southwest corner of the base where two stormwater outfalls discharge onto adjacent off-base property. A construction project has been executed to mitigate this off-base water discharge problem. Stormwater collected on Scherz Boulevard is channeled off base at the boundary fence separating Scherz Boulevard and Fort McKavett Road.

4.3.4 Natural Gas

Goodfellow AFB is supplied with natural gas by Lone Star Gas Company. A 4-inch diameter main supplies the base at the northwest corner near Fort Lancaster Avenue. Gas lateral lines were recently replaced with PVC lines, which do not require cathodic protection. The cantonment area of the base is laid out in a looped system with a couple of non-looped lines that feed gas to the fire training area and the Angelo Inn dormitory complex. The military family housing area is me-

North Gate/Stormwater Detention Pond

tered separately to monitor usage in the housing area.

Although the natural gas infrastructure is in good condition, an annual basewide gas leak survey is conducted. This will ensure the continuation of a safe and efficient operating system. Figure 4.16 illustrates the layout of the natural gas system.

4.3.5 Liquid Fuels

Without an operational airfield, POL infrastructure is limited to the new fire training area. Since this facility was recently constructed, the infrastructure components are new and in good condition.

Liquid fuel is delivered to the base by truck where it is stored in aboveground storage tanks. Storage facilities include three propane tanks, 30,000-gallon, 10,000-gallon, and 3,000-gallon, and an 8,000-gallon jet fuel storage tank.

Figure 4.16 shows the location of the fuel distribution lines and system structures for the fire training area.

4.3.6 Electrical

Electrical service is provided by West Texas Utilities (WTU) through two aerial primary feeders originating at the WTU Concho Plant Substation. A WTU switching station is located on the west side of the base near Fort McKavett Road. Electronically operated switches allow automatic transfer from one feeder to the other in the event of a power interruption. From the WTU switching station, service extends underground to a walk-in switch station located on the north end of the base. As shown in Figure 4.17, this switching station has five circuits that feed electrical service to various parts of the base.

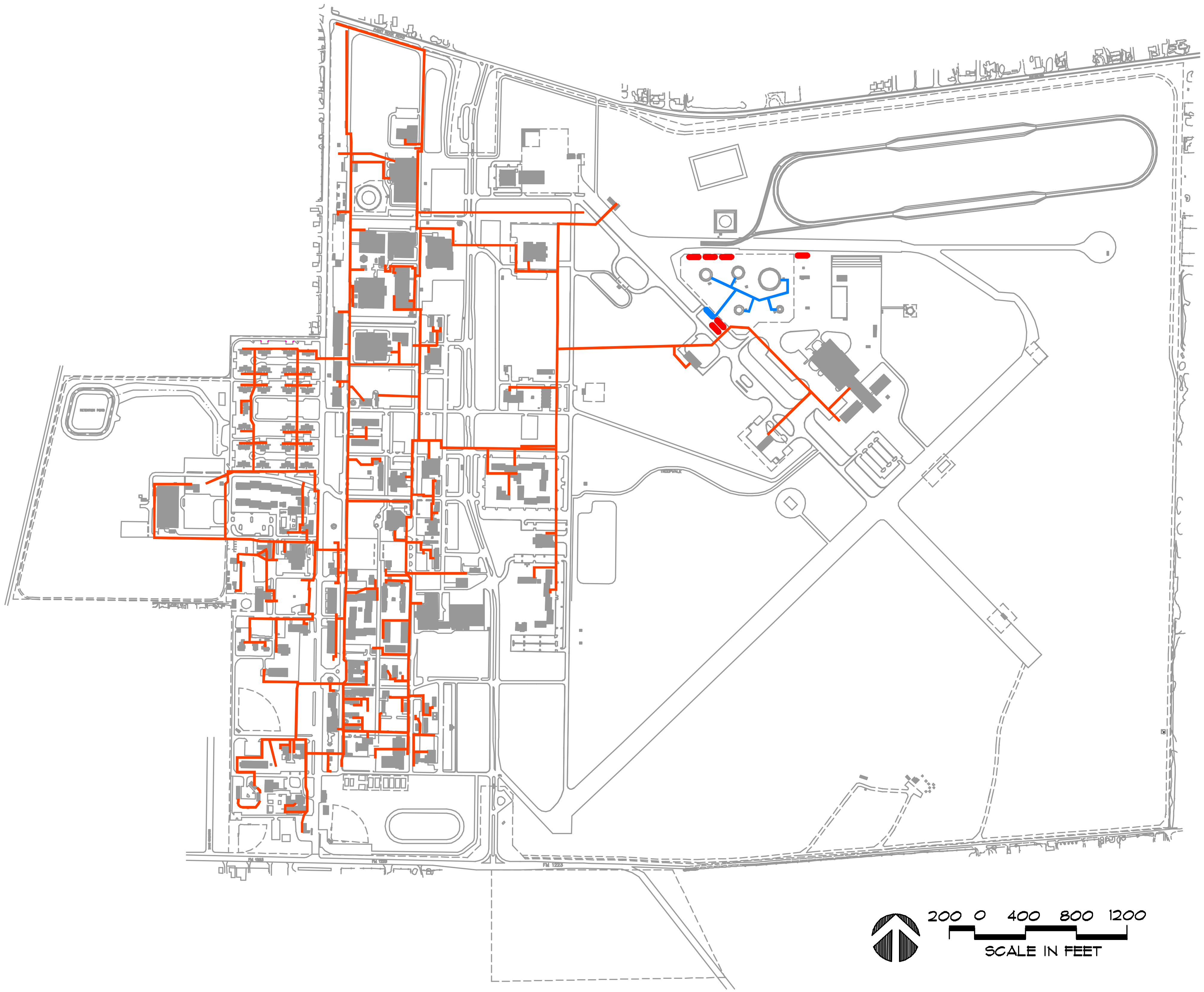
Circuits D and E are underground circuits serving the east side of the base. Circuits A, B, and C consist of a combination of aerial and underground lines feeding the west side of the base. The cantonment area of the base is set up with loop feed transformers and switches to interconnect circuits for temporary backfeed capabilities. Circuits D and E serving the fire training area and the base logistics complex are not set up in a looped configuration and lack temporary backfeed capabilities. Other deficiencies of the distribution system include primary and secondary lines running together in shared conduit, a lack of system maintenance, and the general aging of the system.

The installation has established a goal to replace all overhead utilities with an underground distribution system. An underground system will improve reliability by lessening vulnerability to wind and lightning damage, and increase base beautification by eliminating overhead utility lines. Also, projects to loop circuits D and E and to install an additional switching station at the south end of the base are planned. This will improve system backfeeding capability.

Revised 27 Apr 99

Figure 4.16

Natural Gas and Liquid Fuel Systems



Natural Gas Line

Liquid Fuel Line

Liquid Jet Fuel Storage

LPG (Liquid Petroleum Gas) Storage

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Revised 27 Apr 99

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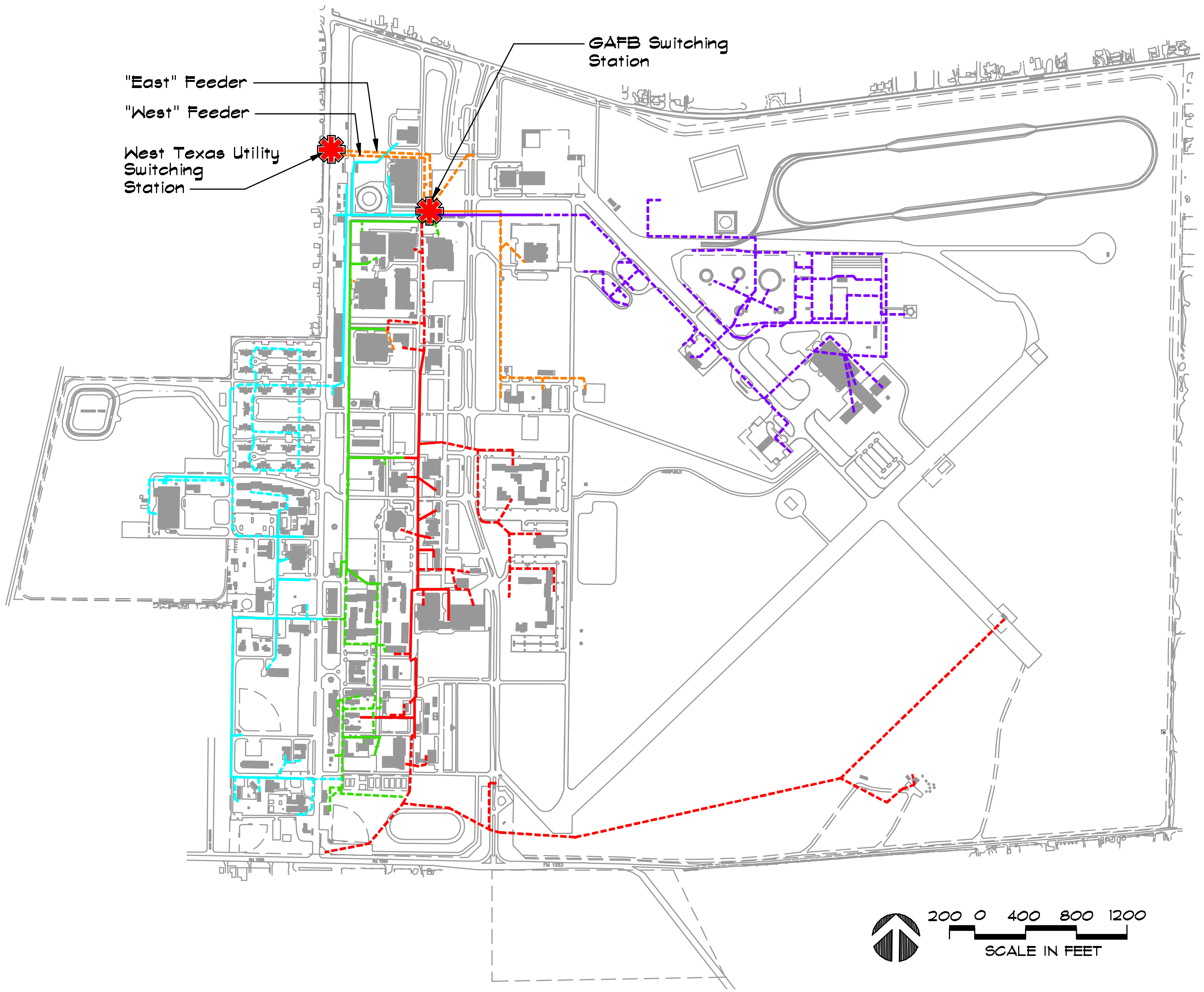
Figure 4.17

Electrical Distribution System



Circuit A

Circuit B

Circuit C

Circuit D

Circuit E

Switching Station

Note: Overhead Transmission Lines are Solid and Underground Transmission Lines are Dashed.

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4.3.7 Central Heating and Cooling

Goodfellow AFB has no central heating, ventilating, air conditioning, and cooling (HVAC) system. Each building, with the exception of one dormitory complex, has its own heating and cooling equipment. Building 259 contains a centralized ammonia chiller plant that serves the dormitory complex, including buildings 238, 239, 240, 241, 242, 243, 250, 251, 252, 255, 256, 257, and 258. Base heating and cooling infrastructure is in adequate shape, but is troubled by aging and outdated equipment.

A state-of-the-art, basewide Energy Management Control System was installed to more efficiently manage energy usage. The system uses existing telephone lines, which feed into the operations control center in Building 3511. This installation has an Energy Savings Performance Contract (ESPC). This program provides a contractor to survey and recommend energy conservation measures (ECM) at Goodfellow AFB. The contractor bears the expense for implementing these projects, and the base pays back the cost of the ECM from actual energy savings.

4.3.8 Communications

The base communications system is in good condition, as most of the infrastructure has been upgraded or completely replaced. The base is served by a newly replaced copper communication system that is government owned and contractor maintained. Most of the cable is in conduit as seen Figure 4.18. Some of the cable has been run through existing manhole and duct systems, and aerial cable exists in a few areas. The copper lines, which were abandoned in place, must be removed before the existing ducts can be used.

The base fiber optic backbone consists of five Information Transfer Nodes (ITN) connecting the base's

Cooling Tower, Intelligence Training Campus

Revised 20 Apr 99

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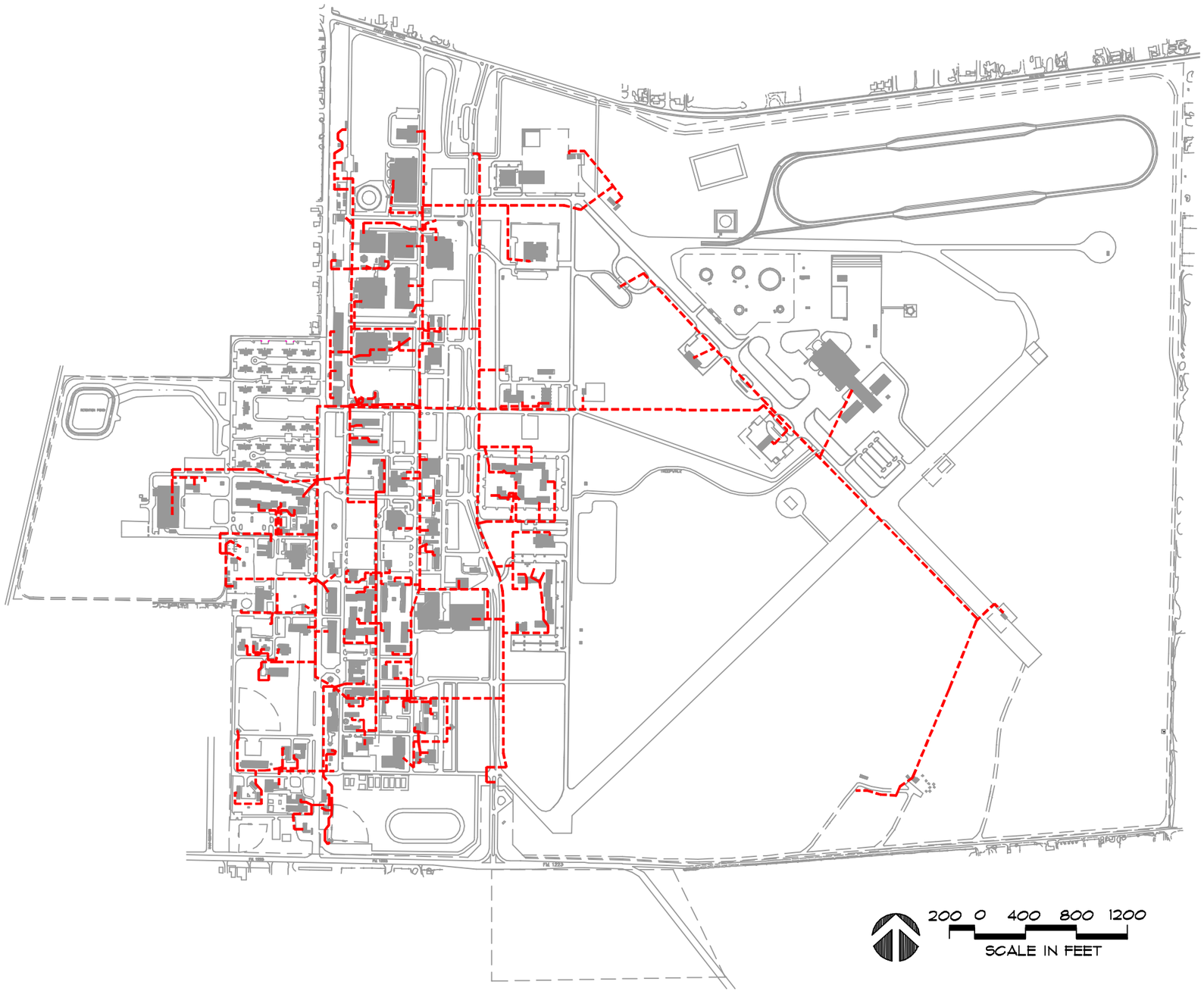
Figure 4.18

Communications Systems, Telephone Feeder Cable



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Scherz Boulevard and Farrow Street

mission essential buildings. These ITNs are diagrammed in Figure 4.19. The completed Base Information Digital Distribution System (BIDDS) program has the capability of taking the base's communication needs into the 21st century.

4.3.9 Base Pavements

Goodfellow AFB has over 29 miles of roads and over 410,500 square yards of paved parking lots. The majority of these surfaces are asphalt, although the main thoroughfare, Kearney Boulevard, is constructed of concrete. Many of the former runway areas are used for base roadways. A gravel surfaced perimeter road, which encircles the former airfield, is only used for security patrol and jogging, and unlikely to be paved in the near future. Recent evaluation of the base pavements indicated that about 80 percent of the pavements are in good condition with the remaining 20 percent in need of repair or maintenance. Inefficient storm drainage across base pavements has greatly shortened their life span and caused rapid deterioration. Additionally the pavement utility cuts required for the BIDDS program have decreased the pavement quality and accelerated its deterioration.

4.4 LAND USE

A land use plan provides direction for the development and improvement of an Air Force Base in which people can work and live in an efficient, aesthetic, and safe environment. This is accomplished through good planning principles, which include collocating compatible or similar types of land uses and separating incompatible land uses.

4.4.1 On Base

An installation's mission operations and its associated uses significantly impact the use of base-owned property. The proposed land use plan should be carefully considered when planning the use and future growth potential of base facilities and land.

20 Apr 99

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Figure 4.19

Communications Systems, Fiber Optic

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4.4.1.1 Existing Land Use Figure 4.20 illustrates the land use patterns as they currently exist at Goodfellow AFB. The following table defines the typical types of facilities found in each land use category:

LAND USE DEFINITIONS

Land Use Category	Map Color	Typical Facilities and Features
Training	Light Blue	Intelligence training and fire training facilities.
Industrial	Gray	Base engineering, maintenance shops, storage, warehousing, utilities.
Administrative	Orange	Headquarters, civilian personnel, law center, security operations.
Community-Commercial	Red	Commissary, clubs, dining hall, recreation center, gym, theater.
Community-Service	Pink	Post office, library, chapel, child care center, education center.
Medical	Violet	Clinic, medical storage.
Housing-Accompanied	Yellow	Family housing.
Housing-Unaccompanied	Ochre	Housing for singles, visitor housing.
Outdoor Recreation	Dark Green	Outdoor courts and fields, swimming pool, ranges, MWR storage.
Open Space	Light Green	Conservation area, buffer space, clearances.

Note: Associated parking is included in land use category.

Past development has been contained to the west side of the base. Kearney Boulevard separates the original development on the west side from the former airfield. While this consolidated development is an efficient use of infrastructure and land, it has allowed a mixture of incompatible land uses to locate next to one another. Recently, as mission requirements have increased, development has expanded east of Kearney Boulevard in the area of the old airfield.

Revised 5 Aug 99

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Figure 4.20

Existing Land Use

- Training Campus
- Industrial
- Administrative
- Community-Commercial
- Community-Service
- Medical
- Housing-Accompanied
- Housing-Unaccompanied
- Outdoor Recreation
- Open Space

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On Base Lanham Family Housing

Residential uses occur at several locations throughout the base adjacent to a mixture of land uses from open space to industrial. Recent residential uses, the student dormitory complexes, are found along the east side of Kearney Boulevard.

Industrial uses are located in the west central part of the base surrounded by officers housing, family housing, and mixed commercial uses. Additional industrial use occurs along Fort Lancaster Avenue at the northern end of the base. This linear industrial area located along the northwestern base boundary is incompatible with residential off-base uses on the west side of Fort McKavett Road. A large industrial area has developed on the northern end of the base encompassing the fire training area, the Department of Transportation test track, and the new civil engineering complex. This area of intensive use is well separated from other incompatible land uses.

Administrative and commercial land uses, while contained within the central developed portion of the base, are scattered.

Outdoor recreation uses are well-clustered at the south end of the base, and pockets of open space are spread throughout the installation. Appropriate use of open space and recreational areas provides a green belt or buffer strip along most of the base boundaries separating base operations from off-base properties.

At the northern end of the base, the intelligence training area is exceptionally well-clustered in a campus-type environment.

The remaining portion of the base is open space. The former airfield is now vacant grassland that contains a former rifle range and a small ammunition storage facility and associated safety clear zones.

With the change from a flying mission, there is an abundance of land available for expansion of facilities and the addition of future missions.

4.4.1.2 Future Land Use Future land use for Goodfellow AFB is graphically illustrated in Figure 4.21.

A Consolidated Wing Headquarters will be located to house many of the base support activities in one convenient facility. Other commercial and administrative uses will be systematically shuffled around to better accommodate current space requirements and provide for more compatible land uses. The intelligence training area will remain located as is, but will continue to be expanded and be enhanced into a campus type of environment. Demolition of deteriorated and inadequate facilities will allow for the development of compatible land uses and provide for the overall upgrade of base facilities.

Future plans include the potential for expansion of military family housing on the west side of the base. This will be adjacent to an existing housing area and bounded on three sides by the base property boundary.

Much of the vacant airfield land is currently available for future mission expansion. Additional area could be made available for future mission expansion with alteration or elimination of the QD zone surrounding the explosive storage facility. This would require a reduction or total elimination of explosives stored in the facility. The area of unaccompanied housing on the east side of Kearney Boulevard can be expanded to the east to facilitate future missions. Similarly, the industrial area in the north has land for expansion.

4.4.1.3 Existing Transportation System As shown in Figure 4.22, the installation has well-defined north and south streets, such as Kearney Boulevard, Scherz Boulevard, and Fort Lancaster Avenue. Vehicular circulation from the north to the south end of the base is easily accomplished. However, when traveling east and west across the base, access between Kearney and Scherz boulevards is difficult. Mitchell, Farrow, Vance, and Canberra streets are the only through east/west routes. These routes, while direct, are ill-defined and narrow. Travelers driving east or west must find one of these four streets or zigzag across the base on various indirect streets.

On-street parking occurs frequently on many roads, causing congestion and safety hazards. The use of the former runway and parking apron surfaces as part of the current base pavement system creates an abundance of parking lots and interior streets making it difficult to distinguish base roads from parking lots. This arrangement can easily confuse visitors and make it difficult for them to reach their desired destination.

Revised 15 Oct 99

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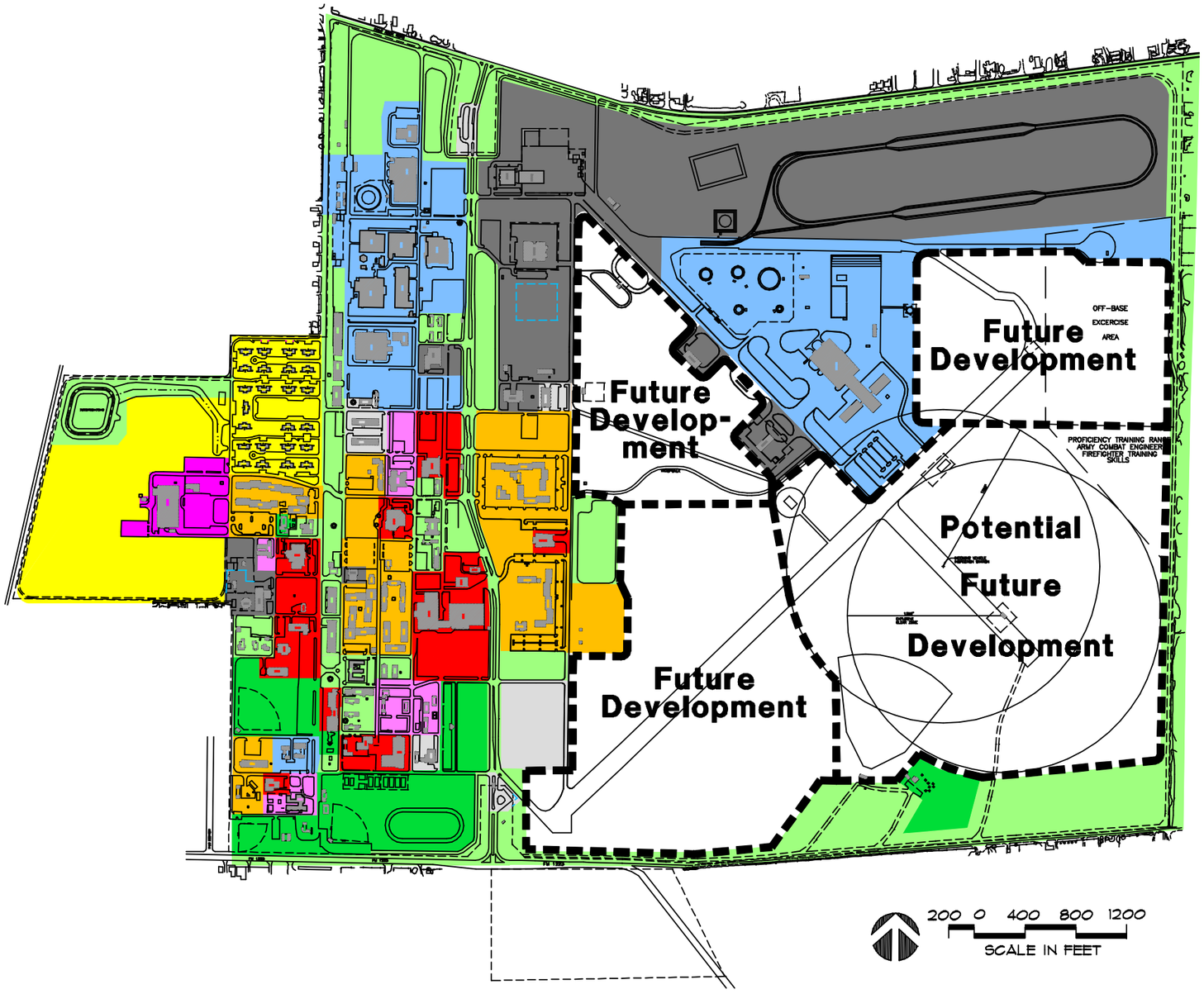
Figure 4.21

Future Land Use



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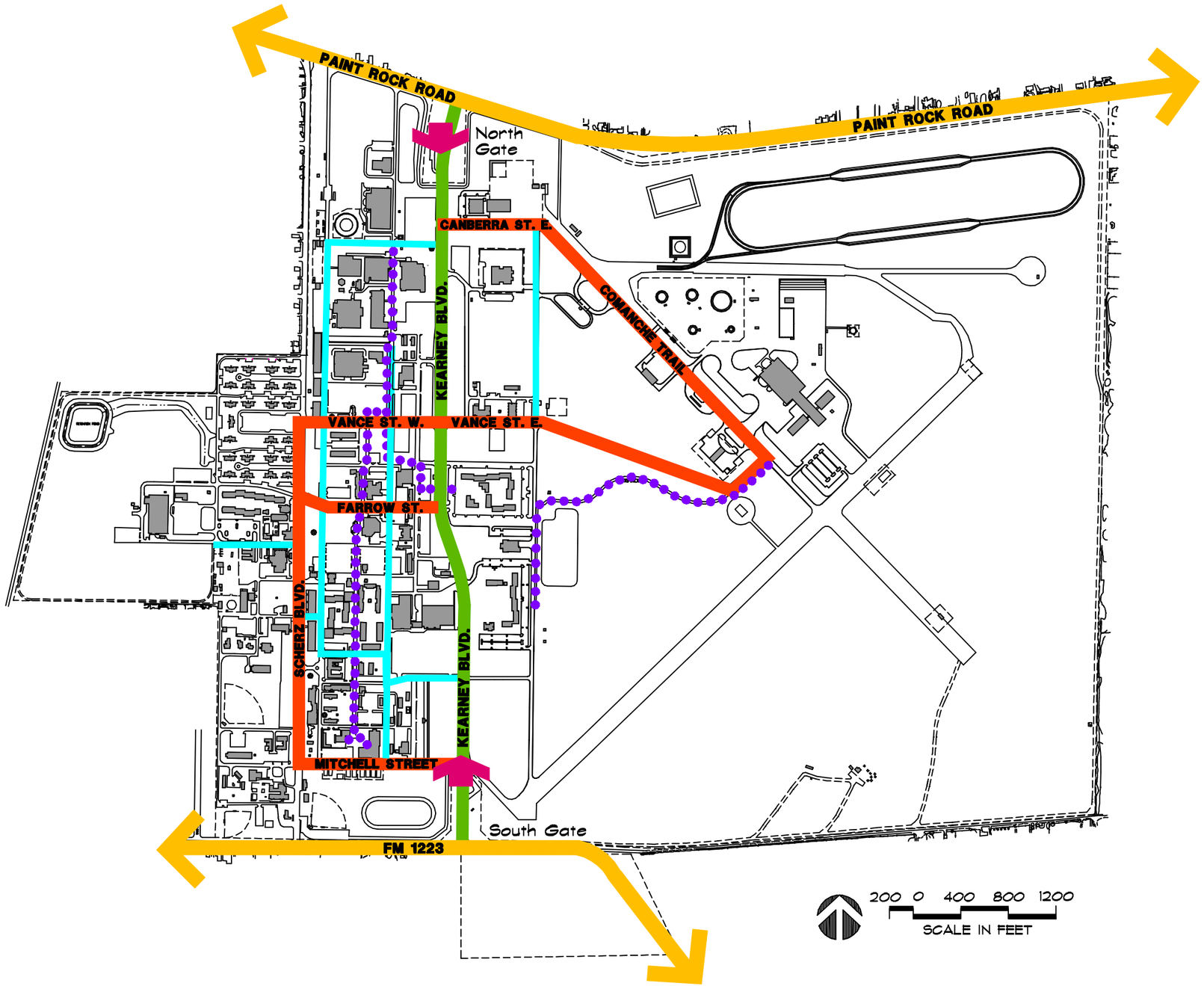
Goodfellow AFB, Aerial View to the North

4.4.1.4 Proposed Transportation System There are several ways to improve the base transportation system, and these are illustrated in Figure 4.23. While north/south streets are currently well established, further enhancements could preserve and improve their function as primary base circulation routes. The existing wide medians and green space along the sides of Kearney Boulevard pronounce its significance as the base's primary north/south route. A dedicated "green belt" should be maintained along the entire length of the boulevard. Scherz Boulevard and Fort Lancaster Avenue need to be linked together just north of Vance Street to develop a continuous, more efficient north/south primary route serving the western half of the base. Apache Trail could be developed into a north/south collector serving the east/central portion of the base upon the expansion of a future mission.

The development of primary east/west routes across the base would allow for more direct and safer travel. Farrow, Vance, Canberra and Mitchell streets are main east/west routes that should be enhanced to become more recognized by the traveler as primary routes. This could be accomplished by street widening, eliminating on-street parking, enlarging the turning radius at intersections, or with landscaping and signage. The relocation of East Canberra Street to the south would align this street with the existing West Canberra Street. This would create a four-way intersection at Kearney Boulevard that is safer and more efficient. This relocation could be done without dis-



Revised 15 Oct 99

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Figure 4.22

Existing Road Network

Revised 27 Apr 99

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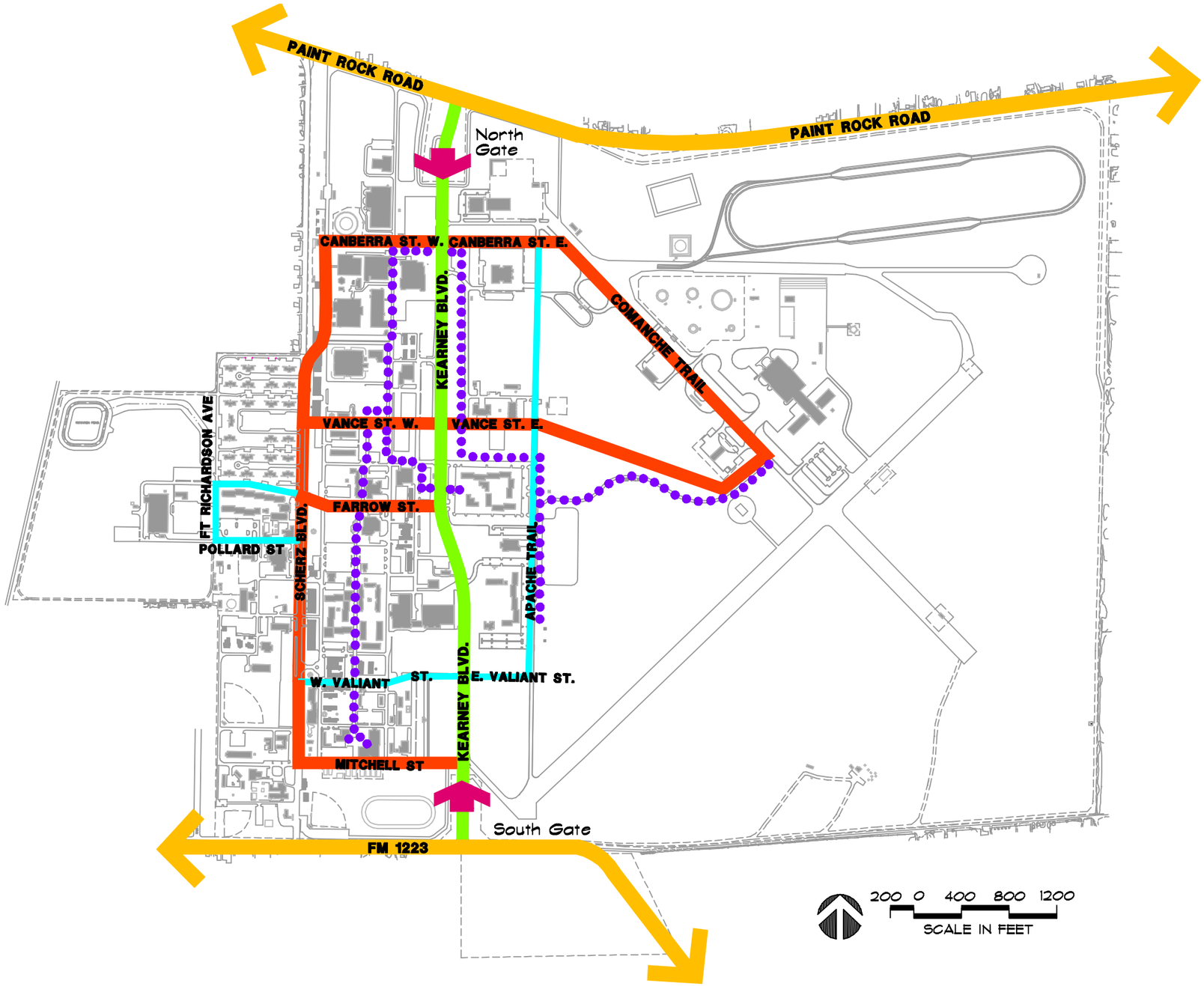
Figure 4.23

Future Road Network



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Single Family Housing West of Base

placing existing facilities, and the future service station could easily reorient its site plan to the new road. This realignment would provide two primary east/west routes spanning from Scherz Boulevard to Apache Trail, Canberra and Vance.

Reconstruction of the Mitchell Street approach to Scherz Boulevard would provide another direct east/west access across the southern portion of the base and reduce the volume of traffic carried on the congested portion of Valiant Street. This would increase pedestrian safety and provide two primary east/west routes from Scherz to Kearney, Farrow and Mitchell.

4.4.2 Off-Base Land Use

Land in close proximity should be developed with consideration to the long-term impact of the base's land use and activities.

4.4.2.1 Existing Land Use

Goodfellow AFB is located within the city limits of San Angelo and surrounded by a variety of zoning districts and land use types representative of urban development.

Primary land use to the north is residential. It is mostly single family housing with some small multi-family developments occurring just across from the north base gate. A pocket of commercial development is located at the corner of Paint Rock Road and Bell Street.

Residential uses are located west of the base along with a church and an elementary school. Oil industry related manufacturing and commercial uses are located southwest of, but not adjacent to, base property. The property directly southwest of the base is presently vacant, undevelopable land.

Off-Base Land Use Surrounding Clinic

While there is a small area of community service type commercial south of the base, most of the land to the south and east of the base is large lot single family, ranch estates, and vast areas of open range land.

4.4.2.2 Future Land Use Future development of the lands surrounding the base are not likely to change from their current use. Nor does the city have any long-range development plans to expand farther east past the base boundaries.

Current and future surrounding land uses are not expected to restrict or constrain any potential development or mission expansion occurring at Goodfellow AFB. The installation has a surplus of land, and it is unlikely that the expansion of base boundaries would occur.